Alg. 2 Warm Up # 6-1 Solve:

1. $\log_x 16 = 2$

2. $\log_2 x = 5$

3. $5^{3x} = \left(\frac{1}{25}\right)^{x+5}$

4. $9x^2 - 25 \le 0$

HW Questions:

Review & Preview

6-51. Use the algebraic strategies you developed in today's lesson to solve the system of equations at right. Be sure to check your solution.

$$\begin{aligned} ①\quad & 2x + y - 3z = -12 \\ ②\quad & 5x - y + z = 11 \\ ③\quad & x + 3y - 2z = -13 \end{aligned}$$

Eliminate y

$① + ② \rightarrow \begin{cases} 7x - 2z = -1 \\ 16x + z = 20 \end{cases}$

$③ + ②(3) \rightarrow$

$3(5x - y + z) = 11(3)$

$15x - 3y + 3z = 33$

$x + 3y - 2z = -13$

$16x + z = 20$

Now solve for x & z,
plug them into one
of the original equations to find y

answer is a point

$\boxed{(x, y, z)}$

HW Questions:

Review & Preview

6-51. Use the algebraic strategies you developed in today's lesson to solve the system of equations at right. Be sure to check your solution.

① $2x + y - 3z = -12$
② $5x - y + z = 11$
③ $x + 3y - 2z = -13$

Eliminate y

3②: $15x - 3y + 3z = 33$
$16x + z = 20$

① + ②: $7x - 2z = -1$

3② + ③: $(16x + z = 20)2$

$32x + 2z = 40$
$7x - 2z = -1$

$39x = 39$

$x = 1$

$\boxed{(1, -2, 4)}$

6-52. Suppose that a two-bedroom house in Nashville is worth \$110,000 and appreciates at a rate of 2.5% each year.

a. How much will it be worth in 10 years? $= 110{,}000(1.025)^t$

b. When will it be worth \$200,000?

$100\% + 2.5\%$

c. In Homewood, houses are depreciating at a rate of 5% each year. If a house is worth \$182,500 now, how much will it be worth two years from now?

6-53. Solve $(\sqrt{5x-1})^2 = (\sqrt{6+4x})^2$ and check your solution.

$5x - 1 = 6 + 4x$
$x = 7$

$\sqrt{5(7)-1} \overset{?}{=} \sqrt{6+4(7)}$
$\sqrt{34} = \sqrt{34}$

6-54. If two quantities are equal, are their logarithms also equal? Consider the questions below.

a. Is it true that 4^2 is equal to 2^4? Is this a special case, or is a^b equal to b^a for any values of a and b?

b. Is $\log 4^2$ equal to $\log 2^4$? How can you be sure?

c. Are the equations $x = 5$ and $\log x = \log 5$ equivalent? Justify your answer.

d. Is the equation $\log 7 = \log x^2$ equivalent to the equation $7 = x^2$? How can you be sure?

$3^2 \neq 2^3$
$5^2 \neq 2^5$

$\log 4^2 \overset{?}{=} \log 2^4$
$4^2 = 2^4$

6-55. Use the ideas from problem 6-54 to help you solve the following equations.

a. $\log 10 = \log(2x - 3)$

$10 = 2x - 3$

b. $\log 25 = \log(4x^2 - 5x - 50)$

6-56. Find an equation for each of the lines described below.

y-intercept

$y = \frac{1}{3}x + 5$

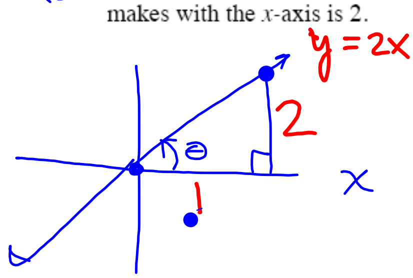
a. The line with slope $\frac{1}{3}$ that goes through the point (0, 5).

b. The line parallel to $y = 2x - 5$ that goes through the point (1, 7).

c. The line perpendicular to $y = 2x - 5$ that goes through the point (1, 7).

Not the y-int, so use pt-slope form

d. The line that goes through the point (0, 0) so that the tangent of the angle it makes with the x-axis is 2.



$\tan\theta = \frac{2}{1} \frac{\text{opp}}{\text{adj}}$

$\boxed{y - y_1 = m(x - x_1)}$

6-57. Solve each equation below for y so that it can be entered into the graphing calculator.

a. $x^2 = x(2x - 4) + y$

b. $x = 3 + (y - 5)^2$

6-58. Sketch the graph of each equation or inequality below.

a. $(x - 2)^2 + (y + 3)^2 = 9$

r^2

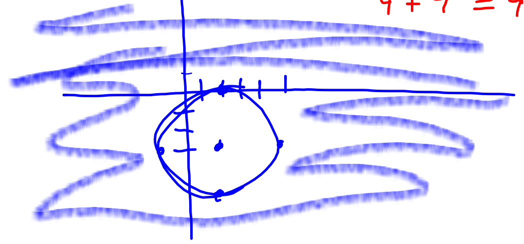
b. $(x - 2)^2 + (y + 3)^2 \geq 9$

center $(2, -3)$ $r = 3$

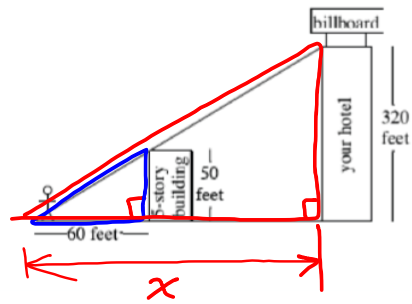
test $(0, 0)$

$(0-2)^2 + (0+3)^2 \overset{?}{\geq} 9$

$4 + 9 \geq 9$ ✓



6-59. You are standing 60 feet away from a five-story building in Los Angeles, looking up at its rooftop. In the distance you can see the billboard on top of your hotel, but the building is completely obscured by the one in front of you. If your hotel is 32 stories tall and the average story is 10 feet high, how far away from your hotel are you?



$$\frac{x}{320} = \frac{60}{50}$$

$$x = 384$$

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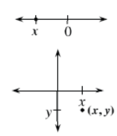
MATH NOTES

Locating Points in Three Dimensions

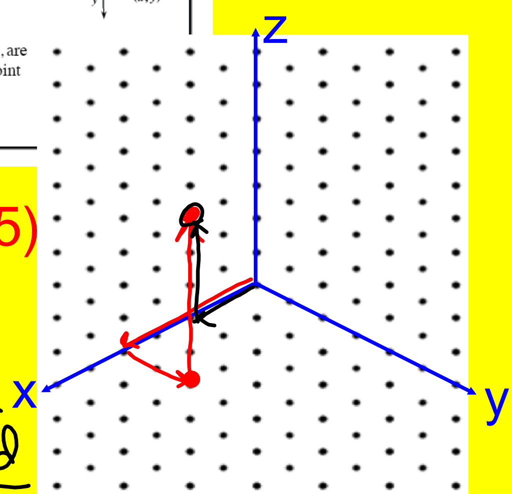


When locating a point on a *number line*, a single number, x, is used.

The location of a point in a *plane* is given by two numbers, (x, y), called an ordered pair.

To locate a point in *space*, three numbers, (x, y, z), are used, which are called an **ordered triple**. The point (2, 3, 1) is shown at right. The dotted lines help clarify which coordinate was graphed.

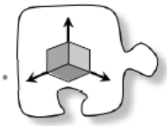
Example: (4, 2, 5)



(2, 0, 3) lands in the same place, so you need the arrows!

CP's: 6- #44 ---> 48 (from Friday)

6.1.4 What is a solution in three dimensions?



Solving Systems of Three Equations with Three Unknowns

Today you will extend what you know about systems of equations to examine how to solve systems of equations with three variables. As you work with your team, look for connections to previous work. The focus questions below can help generate mathematical discussion.

What does a solution to a system in three variables mean?

What strategies can we use?

What does the intersection look like?

6-44. Review the strategies for solving systems that you already know as you solve the following two-variable system of equations. Use any method. Do not hesitate to change strategies if your first strategy seems cumbersome. If there is no solution, explain what that indicates about the graph of this system. Leave your solution in $\boxed{(x, y)}$ form.

$$12x - 2y = 16$$
$$30x + 2y = 68$$

Equal Values
Elimination
Substitution

6-45. Solve the following three-variable system of equations by graphing it with your graphing tool or on isometric dot paper. Give your solution in (x, y, z) form. Then test your solution in the equations and describe your results.

$$2x + 3y + 3z = 6$$
$$6x - 3y + 4z = 12$$
$$2x - 3y + 2z = 6$$

6-46. FINDING AN EASIER WAY

As you saw in problem 6-45, using a graph to solve a system of three equations with three variables can lead to inconclusive results. What other strategies should be considered? Discuss this with your team and be prepared to share your ideas with the class.

Elimination & Substitution

6-47. Looking at the equations in problem 6-45, Elissa wanted to see if she could apply some of her solving techniques from two-variable equations to this three-variable system.

a. Elissa noticed that the first two equations could be combined to form the new equation $8x + 7z = 18$. How did she accomplish this? Explain.

b. Now that Elissa has an equation with only x and z, she needs to find another equation with only x and z to be able to solve the system. Choose a different pair of equations to combine and find a way to eliminate y so that the new equation only has x and z. Then solve the system to find x and z.

c. For which variable do you still need to solve? y Work with your team to solve for this variable. Then write the solution as a point in (x, y, z) form.

d. Is your solution reasonable? Does it make sense? Does it agree with your graph?

a) ① $2x + 3y + 3z = 6$
② $6x - 3y + 4z = 12$
$\boxed{8x + 7z = 18}$

b) ③ $2x - 3y + 2z = 6$
① $2x + 3y + 3z = 6$
$-2\boxed{(4x + 5z = 12)}$

$8x + 7z = 18$
$-8x - 10z = -24$
$-3z = -6$
$z = 2$

$8x + 7(2) = 18$
$-14 \quad -14$
$\frac{8x}{8} = \frac{4}{8}$
$x = \frac{1}{2}$

c) $2\left(\frac{1}{2}\right) + 3y + 3(2) = 6$
$-6 \quad -6$
$1 + 3y = 0$
$-1 \quad -1$
$\frac{3y}{3} = -\frac{1}{3}$
$y = -\frac{1}{3}$

$\boxed{\left(\frac{1}{2}, -\frac{1}{3}, 2\right)}$

d) Check: ② $\rightarrow 6\left(\frac{1}{2}\right) - 3\left(-\frac{1}{3}\right) + 4(2) \stackrel{?}{=} 12$

$3 + 1 + 8 = 12$
$12 = 12$ ✓

6-48. Practice using your algebraic strategies by solving the systems below, if possible. If there is no solution or if the solution is different than you expected, use the graphing tool to help you figure out why.

a. 1 $x+y+3z=3$
2 $2x+y+6z=2$
3 $2x-y+3z=-7$

b. $20x+12y+15z=60$
$20x+12y+15z=120$
$10x+20z=30$

c. $5x-4y-6z=-19$
$-2x+2y+z=5$
$3x-6y-5z=-16$

d. $6x+4y+z=12$
$6x+4y+2z=12$
$6x+4y+3z=12$

Eliminate y

1 + 3 $\rightarrow$ $3x+6z=-4$

2 + 3 $\rightarrow$ $4x+9z=-5$

Now solve system for x & z, plug in to find y.

6-48. Practice using your algebraic strategies by solving the systems below, if possible. If there is no solution or if the solution is different than you expected, use the graphing tool to help you figure out why.

a. $x+y+3z=3$
$2x+y+6z=2$
$2x-y+3z=-7$

b. 1 $20x+12y+15z=60$
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c. $5x-4y-6z=-19$
$-2x+2y+z=5$
$3x-6y-5z=-16$

d. $6x+4y+z=12$
$6x+4y+2z=12$
$6x+4y+3z=12$

Elim y

1 − 2 $\rightarrow$ $0x+0y+0z=-60$

$0 \neq -60$

CP's: 6- # 60, 61, 64, 65

6.1.5 How can I apply systems of equations?

Using Systems of Three Equations for Curve Fitting

In this lesson you will work with your team to find the equation of a quadratic function that passes through three specific points. You will be challenged to extend what you know about writing and solving a system of equations in two variables to solving a system of equations in three variables.

together:

6-60. In your work with parabolas, you have developed two forms for the general equation of a quadratic function: $y = ax^2 + bx + c$ and $y = a(x-h)^2 + k$. What information does each equation give you about the graph of a parabola? Be as detailed in your explanation as possible. When is each form most useful?

$y = a(x-d)(x-e) \longrightarrow$ "a" gives us stretch or compression and whether it is reflected in the x-axis.

x-int: $(d, 0)$
$(e, 0)$

$y = a(x-h)^2 + k \longrightarrow$ "a" is same as above
vertex (h, k)

$y = ax^2 + bx + c \longrightarrow$ "a" is same as above
y-int: $(0, c)$

6-61. Suppose the graph of a quadratic function passes through the points $(1, 0)$, $(2, 5)$, and $(3, 12)$. Sketch its graph. Then work with your team to develop an algebraic method to find the equation $y = ax^2 + bx + c$ of this specific quadratic function.

Discussion Points

What does the graph of any quadratic function look like? parabola

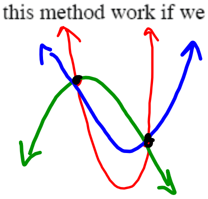
What does it mean for the graph of $y = ax^2 + bx + c$ to pass through the point $(3, 12)$? when $x = 3$, $y = 12$. It's a solution to the equation.

What solving method can we use to find a, b, and c? Solve a system

How can we check our equation? Plug points on the parabola into the equation to make sure they work.

Would this method allow us to find the equation of a quadratic using *any* three points? yes

Would this method work if we only had two points? No.



Many parabolas can pass through 2 given points. You need 3 pts to determine a unique parabola.

6-64. Find the equation $y = ax^2 + bx + c$ of the function that passes through the three points given in parts (a) and (b) below. Be sure to check your answers.

a. (3, 10), (5, 36), and (–2, 15)   b. (2, 2), (–4, 5), and (6, 0)

$y = ax^2 + bx + c$

x y

$(3, 10) \rightarrow 10 = a(3)^2 + b(3) + c \rightarrow 9a + 3b + c = 10$

$(5, 36) \rightarrow 36 = a(5)^2 + b(5) + c \rightarrow 25a + 5b + c = 36$

$(-2, 15) \rightarrow$

6-65. What happened in part (b) of problem 6-64? Why did this occur? (If you are not sure, plot the points on graph paper.)

HW: 6 - # 71---> 79